

## Geodetic Observatory TIGO in Concepción

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### Abstract

During the seventh year of operation in Chile, TIGO carried out 110 successful VLBI observations. Activities of the VLBI group at TIGO during 2008 and an outlook for 2009 are given.

### 1. General Information

The operation of TIGO is based on a bilateral agreement between Chile and Germany in which:

- Universidad de Concepción
- Instituto Geográfico Militar
- Bundesamt für Kartographie und Geodäsie

are cooperating. TIGO is located near the Universidad de Concepción, at longitude 73.025 degrees West and latitude 36.843 degrees South, 500 kilometers south of Santiago, the Chilean capital.

### 2. Component Description

The IVS network station TIGOCONC is the VLBI part of the Geodetic Observatory TIGO, which was designed to be a fundamental station for geodesy. Hence the VLBI radiotelescope is co-located with an SLR telescope (ILRS site), a GPS/Glonass permanent receiver (IGS site) and other instruments such as water vapor radiometer, seismometer, superconducting gravity meter and absolute gravity meter.

The atomic clock ensemble of TIGO consists of three hydrogen masers, three cesium clocks and three GPS time receivers, realizing the Chilean contribution to the Universal Time scale (Circular T, BIPM).

The technical parameters of the TIGO radiotelescope as published in [1] have not been changed.

### 3. Staff

During this year Carlos Verdugo terminated his job in TIGO and was replaced by Pedro Zaror as a mechanical engineer. Two electronic engineer students also joined the VLBI team this year: Cristian Duguet and Miguel Soto. The 2008 TIGO VLBI group consisted of the persons listed in table 1.

### 4. Current Status and Activities

During 2008 TIGO was scheduled to participate in 110 IVS experiments (see table 2) and one 24-hour experiment framed by the TANAMI program [2]. TIGO also participated in its second CONT campaign with 15 days of continuous observations.



Figure 1. Current VLBI Staff (Sobarzo, Oñate, Neumann, Zaror, Duguet, Jara, Herrera, Hase and Soto).

On May 22nd, TIGO took part in the first four continent real-time e-VLBI observation as part of the TERENA Networking Conference 2008. This time TIGO, with the joint effort of the REUNA and CLARA educational networks, could reach 64 Mbps of sustained data rate throughout the run of the demo. (See figure 2.)

This year Sergio Sobarzo finished his Doctoral Thesis named *Multipath Routing for e-VLBI* [3]. The development allows the attainment of higher available bandwidths using different paths between the observing station and the correlator. The system also has a custom load control in order to balance the used bandwidth according to network conditions, e.g., the delay. In figure 3 the increase in the resulting throughput by using two different paths can be seen.

These achievements are proofs of concept, but their application to production e-VLBI is not yet deployed.

## 5. Future Plans

The VLBI activities in 2009 will be focused on:

- execution of the IVS observation program for 2009
- continuation of developments:
  - investigations related to e-VLBI
  - new monitor and control system for the receiver
- repetition of the local survey

Table 1. TIGO-VLBI support staff in 2008.

Staff	Function	Email
Hayo Hase	Head	hayo.hase@tigo.cl
Sergio Sobarzo	Chief Engineer	sergio.sobarzo@tigo.cl
Eric Oñate	Electronic Engineer	eric.onate@tigo.cl
Cristóbal Jara	Electronic Engineer	cristobal.jara@tigo.cl
Cristian Herrera	Information Engineer	cristian.herrera@tigo.cl
Pedro Zaror	Mechanical Engineer	pedro.zaror@tigo.cl
Cristian Duguet	Electronic Engineer	cristian.duguet@tigo.cl
Miguel Soto	Electronic Engineer	miguel.soto@tigo.cl
Jenny Neumann	Secretary	jenny.neumann@tigo.cl
any VLBI operator	on duty	vlbi@tigo.cl
all VLBI operators		vlbistaff@tigo.cl

Table 2. TIGO's IVS observation statistics for 2008.

Name	# of Exp.	OK	Failed
R1xxx	25	25	0
R4xxx	50	50	0
R&D	6	6	0
OHIGxx	7	7	0
T20xx	7	7	0
Tanami	1	1	0
C08xx	15	14	1
Total IVS	111	110	1

## References

- [1] Vandenberg, N.R.: International VLBI Service for Geodesy and Astrometry 1999 Annual Report, NASA/TP-1999-209243, 1999.
- [2] M. Kadler, R. Ojha, S. Tingay and J. Lovell, *The TANAMI Program: Southern Hemisphere VLBI Monitoring of Relativistic Jets in Active Galaxies*, American Astronomical Society, AAS Meeting #211, #04.13; Bulletin of the American Astronomical Society, Vol. 39, p.732.
- [3] Sergio K. Sobarzo, Sergio N. Torres and Hayo Hase, *Multipath Routing for e-VLBI*, paper submitted to Computer and Geosciences Journal, Elsevier.

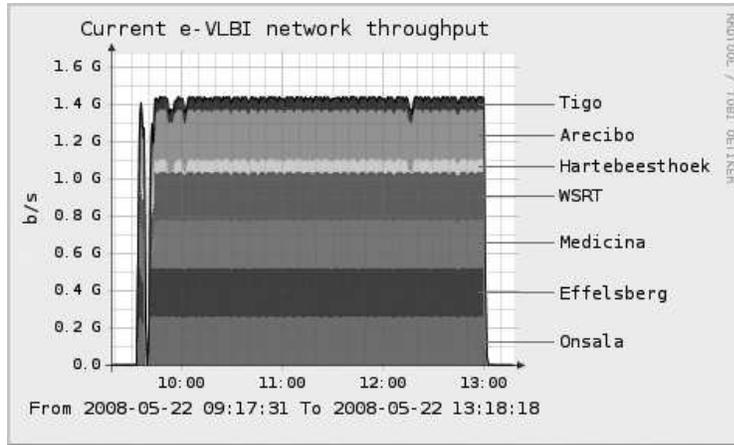


Figure 2. Resulting throughput of all telescopes involved in the TERENA Networking Conference 2008 demo.

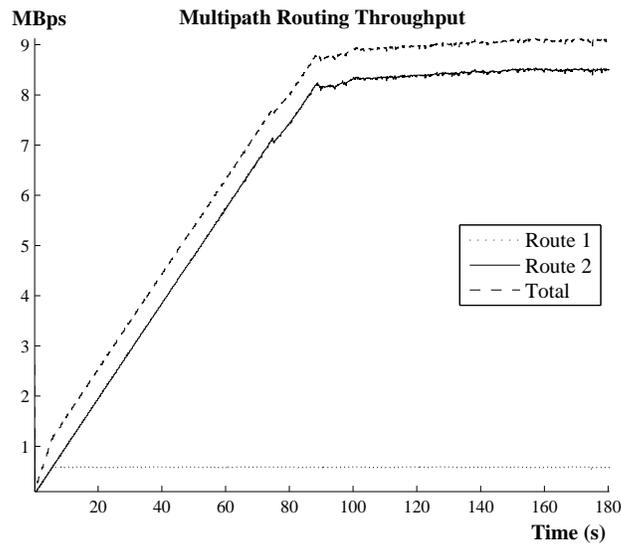


Figure 3. Resulting throughput obtained by using two different paths between TIGO and JIVE networks.